

## Summary of Scientific Results – 2001

The year passed at the Subaru Telescope with astronomical research continuing on schedule with discoveries made frequently into areas of the sky relatively close by and those toward the edge of the Universe. The full suite of instruments at Subaru was up and running, providing data to scientists and information to the world while unlocking new mysteries of discovery along our cosmological journey.

While some astronomers looked deep toward the galactic frontier, others stayed close to home observing familiar environs and making untold discoveries. One of these events centered on the Comet LINEAR, which was initially imaged by Subaru in 2000. For the first time, researchers measured the formation temperature of ammonia ice in a comet, and, with that information, were able to determine the environment in which the comet was born. Previously, investigations into comet evolution focused on water ice, while this study at Subaru measured a different molecule to resolve the comet's formation temperature.

Just a little further outward in our Solar System beyond the orbit of Neptune, lies the Edgeworth-Kuiper belt, a region first discovered in 1992, consisting of small bodies composed largely of frozen volatiles (ices). The Kuiper belt is believed to be the main repository for periodic comets, those with orbits lasting less than 200 years. In February, a team of Japanese astronomers discovered nine new Edgeworth-Kuiper belt objects (EKBOs); these are the first EKBOs discovered by astronomers from Japan.

Toward the constellation Cygnus, approximately 2000 light years away, sits a well-known star-forming region called Sharpless 106 Nebula (S106). For the first time, a detailed and sharp image of S106 was taken, and many faint objects with masses less than an ordinary star like our Sun were discovered. Inspection of the image reveals hundreds of low-mass brown dwarf stars throughout the nebula. Just a little farther away, our nearest galactic neighbor, the Andromeda Galaxy M31, is located 2.3 million light years away. Because of its close proximity, it has served as the foundation to our understanding of how galaxies take shape and evolve and the focal point for voluminous galactic study. Using Suprime-Cam, images were taken of M31 showing clear and sharp resolution of the stars, star clusters, and nebula as if we were within that galaxy. These observations and sharp wide-field images expand our knowledge of the formation and evolution of stars within M31 and elsewhere.

One of the most interesting and exciting phenomena in the Universe is a supernovae explosion. These objects shine brightly with the brilliance of over a billion Suns; however, they only do so for about a month, making their observation extremely rare. Recently, astronomers at Subaru discovered seven

new supernovae. All are very faint and very far away, approximately 8 billion light years. This discovery is significant because supernovae are used to gauge galactic distances, which, in turn is used to study the structure and evolution of the Universe.

Shortly after First Light, a very long exposure resulting in a very deep image was taken at near-infrared wavelengths as part of our Subaru Deep Field study. Analysis of the image showed it to be the deepest image of the Universe ever taken while detecting some of the faintest galaxies ever viewed down to a magnitude of 24.5. The image reveals that discrete galaxies account for more than 90% of all galactic light in the Universe; nevertheless, measurements from satellites have revealed that extragalactic background light is 3 times larger. Resolving the discrepancy between the amount of near-infrared light due to galaxies versus the amount of background light will be an important challenge for future astronomers.